

## Diluted NH<sub>4</sub>F-Based Wet Chemistry for Pre-Gate Clean

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Ultra-clean and atomically flat Si(100) surface will be required at pre-gate clean step in the future CMOS device manufacturing.<sup>1</sup> Currently, RCA-based cleanings are predominant in semiconductor manufacturing, which may not meet demanding requirements as the electronic devices are shrinking.<sup>2</sup> To challenge this task, alternative chemistries and processes have to be investigated in terms of cost of ownership and process performance.<sup>3-5</sup> In the present work, we will focus on a two step process consisting of a oxidation and a diluted NH<sub>4</sub>F-based solution for pre-gate clean. We have used scanning tunnelling microscopy (STM), attenuated total reflection Fourier transform infrared spectroscopy (ATR-FTIR), X-ray photoelectron spectroscopy (XPS) and total reflection X-ray fluorescence spectrometry (TXRF) to study the silicon surfaces after treatment and correlate them to electrical properties of thin gate oxide. Our results indicate that ultra-clean and smooth Si(001) surfaces obtained by treatment with various NH<sub>4</sub>F-based solutions has better performance than those treated with modified RCA clean. We emphasize that our cleaning chemistry is much more cost effective than RCA clean by reducing a lot of chemicals in pre-gate clean step.

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